Aug. 31, 1965 R. A. ROBINSON 3,203,251

PIPETTE APPARATUS

Filed March 19, 1963

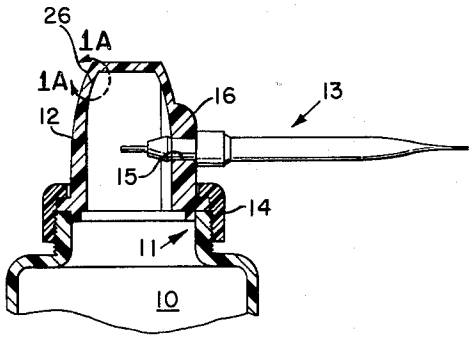


FIG. 1

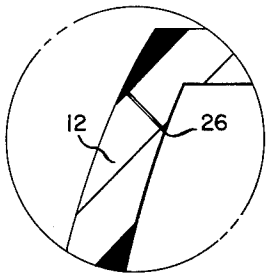


FIG. 1A

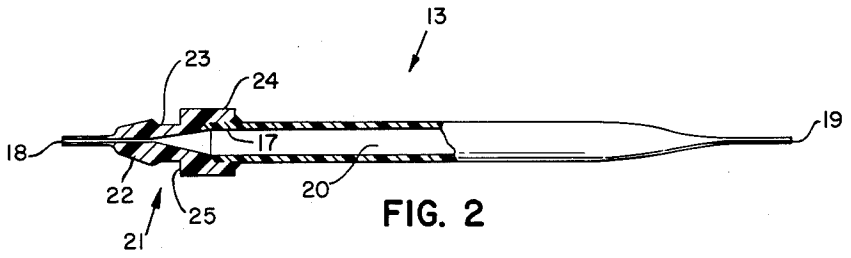


FIG. 2

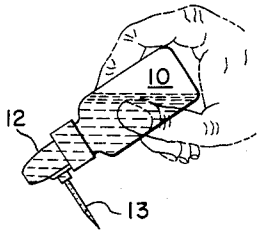


FIG. 3

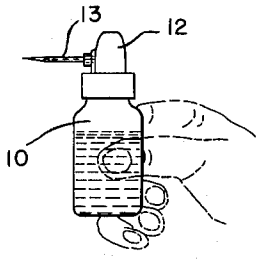


FIG. 4

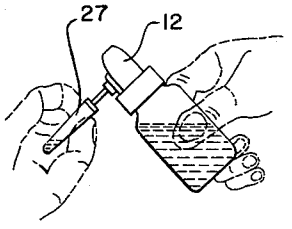


FIG. 5

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PIPETTE APPARATUS

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5 Claims. (Cl. 73—425.6)

This invention relates to an improved precision pipette of a type, for example, as shown in United States Patent 2,974,528.

Precision pipettes are employed for measuring and dispensing accurate volumes of fluid. One type of pipette includes a hollow, generally cylindrical, body portion which holds the major portion of the precise volume to be dispensed. The body portion terminates in capillary passages, the volume within the pipette being determined by the meniscuses formed at the capillary ends.

Pipettes of the above character are not infrequently mounted upon squeeze bottles which form a reservoir for holding liquid sample. By squeezing the bottle the pipette is loaded with an exact volume of liquid sample. Air valves have been provided so that when the bottle is released, air enters the reservoir from the surrounds to allow the liquid in the pipette to remain. Then, by squeezing the bottle and holding closed the valve means, the pipette dispenses its contents.

Pipette apparatus of the foregoing kind in general has been quite satisfactory. However, it is a continuing objective in manufacture of apparatus of this kind to make it as simple to manipulate as is possible so that it can be used with less skilled personnel. Furthermore, it is an objective to minimize the manufacturing cost of apparatus of this kind.

In certain prior pipette structures liquid sample has been free to escape the container via the air valve. While in some instances this is not particularly harmful, it will be evident that it is undesirable to manipulate the air valve with a finger when corrosive or harmful liquid samples are being handled.

Accordingly, in general it is an object of the present invention to provide an improved micro-pipette apparatus.

It is a more specific object of the present invention to provide a more easily manipulated pipette apparatus.

Still another object of the invention is to provide an extremely simplified pipette apparatus utilizing an air valve of capillary dimensions which permits air to flow into the reservoir while preventing liquid flow through same.

These and other objects of the invention will be more readily apparent from the following detailed description and drawing of a preferred embodiment thereof.

In the drawings:

FIGURE 1 shows a side elevation section view of pipette apparatus according to the invention.

FIGURE 1A is a detail view of the portion 1A—1A of FIGURE 1.

FIGURE 2 shows a side elevation view partially in section of a pipette which can be utilized in the structure shown in FIGURE 1.

FIGURES 3 through 5 diagrammatically represent the manipulation of pipette apparatus according to the invention.

In general, a pipette assembly is provided for delivering a measured volume of liquid from a deformable reservoir which holds liquid sample. A dome closes the reservoir and supports a micro-pipette. The pipette includes a generally cylindrically-shaped hollow body portion, and capillary passages at each end. One of the capillary passages extends into the dome in fluid communication therewith. In order to simplify manipulation of the pipette apparatus, there is provided a vent of

capillary dimensions in the dome to permit fluid-flow therethrough of air while precluding fluid-flow therethrough of liquid. The open end of the pipette which extends into the dome is dimensioned to provide less resistance to liquid flow therethrough under pressure within said dome than is provided by the vent.

Referring to the drawing, a reservoir, such as the deformable flask or bottle **10** of suitable material, such as polyethylene supports a dome assembly **11**. Assembly **11** comprises a generally cup-shaped dome **12**, pipette **13**, and retaining ring **14**. Dome **12** forms a closure for reservoir **10**.

Means for mounting pipette **13** in dome **12** includes the opening **15** formed with a flat surface **16** around the outer end thereof.

While various pipettes can be utilized in accordance with the invention, a preferred pipette is shown in FIGURE 2. Pipette **13** includes a single continuous integral interior surface **17** bounded at each end by capillary passages **18** and **19**. Between passages **18**, **19** a body portion **20** is disposed having a relatively large volume. A molded ferrule **21** is formed to include a conically-shaped surface **22**, an annular groove **23** together with a collar **24**. Between groove **23** and collar **24** is a shoulder **25** which, when installed, abuts surface **16**.

Vent means of capillary dimension which will admit air under atmospheric pressure into the reservoir while precluding the escape of liquid is provided near the top of dome **12**. As shown in FIGURE 1A a single hole **26** extends through the wall of dome **12** from the outer to the inner surface thereof. Accordingly, the length of hole **26** is very short. In one example, hole **26** had a diameter of .005 inch.

From the general operation of apparatus of this kind, as explained above, and as explained in detail further below, it will be apparent that capillary passage **18** of pipette **13** must provide an opening dimensioned to have less resistance to liquid flow therethrough under pressure from within dome **12** than is true of vent **26**. Passage **18** must, however, remain sufficiently small to form the retaining meniscus necessary to precision pipettes as refered to herein. Accordingly, in the above example, the diameter of passages **18**, **19** was on the order of .015 and .003 inch, respectively.

As mentioned above, it is an objective of the present invention to provide a pipette apparatus requiring as little manipulative skill as possible. Accordingly, using the present arrangement in one procedure known as reagent pipetting, the assembly is tipped, dome down, as shown in FIGURE 3 so as to fill the dome with liquid sample. Slight pressure is exerted on the sides of the bottle by squeezing, thereby filling the pipette until drops of liquid sample leave the tip. The bottle is then turned upright, and the pressure released. Air enters via vent **26**. Liquid sample is therefore not withdrawn from pipette **13**. Any drop remaining at either tip of pipette **13** can be shaken off or wiped off so as to provide precise volume of liquid sample. Subsequently, the pipette contents are expelled by squeezing the bottle sufficiently to build up more air pressure in dome **12** than vent **26** can release.

In the procedure known as transfer pipetting wherein liquid sample is to be withdrawn from a test tube, as shown in FIGURE 5, and expelled into another container, the tip of the pipette is inserted into liquid sample as contained in a test tube **27**. The bottle is squeezed very lightly, and released. The pipette will fill slowly and possibly slightly overflow into the reservoir **10**. Tapping lightly removes any drop from either tip of the pipette. Transfer of the liquid sample is then effected by squeezing the bottle to discharge the pipette contents as desired.

From the foregoing it will be evident that the above described pipette assembly provides extremely simple operation utilizing a minimum of hand movements and manipulation. It will further be apparent that there are no valve manipulations or moving parts involved in the above structure. Furthermore, it will be appreciated that harmful or corrosive liquids cannot escape from the reservoir except through the tip of the pipette.

I claim:

1. A pipette assembly for delivering a measured volume of liquid comprising a deformable reservoir for holding liquid contents to be delivered, a cup-shaped dome, means retaining said dome to form a closure for said reservoir, a vent consisting of a single hole extending through the wall of said dome, a micro-pipette having a cylindrically-shaped hollow body portion, capillary passages formed at each end of said body portion to retain for delivery a precise volume of liquid defined between meniscuses formed within each said capillary passage, means for mounting said body portion with one of said passages extending into said dome in fluid communication with the interior thereof, the last said passage providing an opening dimensioned to provide less resistance to liquid flow therethrough under pressure from within said dome when the assembly is inverted for filling than provided by said vent, said pipette offering more resistance to gas flow therethrough into said dome when the pipette is filled with liquid and disposed upright than the gas flow resistance of said vent at such time.

2. Pipette apparatus as defined in claim 1 wherein said vent has a diameter on the order of .005 inch, the capillary passage within said dome has a diameter on the order of .015 inch, and the other capillary passage has a diameter on the order of .003 inch.

3. Pipette apparatus as defined in claim 1 wherein the ratio of the diameter of said vent to the diameter of the opening in the passage within the dome is 1 to 3.

4. In pipette apparatus for delivering a measured volume of liquid and having a deformable reservoir for holding liquid to be delivered, a dome assembly comprising a cup-shaped dome, means retaining said dome to form a closure for said reservoir, a vent consisting of a single hole extending through the wall of said dome, a micro-pipette having a cylindrically-shaped hollow body portion, capillary passages formed at each end of said body portion to retain for delivery a precise volume of liquid defined between meniscuses formed within each said capillary passage, means for mounting said body portion with one of said passages extending into said dome in fluid communication with the interior of the dome, the inner end of said vent and of said pipette being disposed and exposed to be submerged in liquid whenever the apparatus is inverted to permit the pipette to be filled during such inversion by applying pressure build-up within the dome, said vent being dimensioned to preclude liquid flow therefrom prior to emergence of flow through the pipette when the outer end of the latter is held below the vent, the inner capillary passage providing an opening dimensioned to offer less resistance to liquid flow therethrough under pressure from within the dome when the apparatus is inverted than offered by said vent at such time, the other capillary passage being formed and dimensioned to provide greater resistance to gas flow through the pipette into the dome when the pipette is filled with liquid and disposed upright than the gas flow resistance of the vent at such time.

5. A pipette assembly for delivering a measured volume of liquid comprising a deformable reservoir for holding liquid contents to be delivered, a cup-shaped dome, means retaining said dome to form a closure for said reservoir, a vent consisting of a single hole extending through the wall of said dome, a micro-pipette having a cylindrically-shaped hollow body portion, capillary passages formed at each end of said body portion to retain for delivery a precise volume of liquid defined between meniscuses formed within each said capillary passage, means for mounting said body portion with one of said passages extending into said dome in fluid communication with the interior thereof, the inner end of said hole and of said one of said passages both being disposed and exposed to be submerged in the liquid contents from the reservoir upon inversion of the assembly for filling said pipette when the assembly is inverted, the openings of said vent and pipette being dimensioned with respect to each other to pass liquid into said pipette in preference to passing liquid through the vent when the apparatus is inverted for filling, and when the pipette is filled and the apparatus disposed upright to pass air into the dome via the vent in preference to entry of gas into the dome via the pipette.

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